

# British thermal unit

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The **British thermal unit** (BTU or Btu) is a unit of energy used in the power, steam generation, and heating and air conditioning industries. Although it is still used 'unofficially' in metric English-speaking countries (such as Canada, the United Kingdom, and sometimes in New Zealand), it is increasingly an outmoded and outdated unit of measure. Elsewhere (and always in scientific use) the BTU has been replaced by the SI unit of energy, the joule (J).

In North America, the term "BTU" is used to describe the heat value (energy content) of fuels, and also to describe the power of heating and cooling systems, such as furnaces, stoves, barbecue grills, and air conditioners. When used as a unit of power, BTU *per hour* (BTU/h) is understood, though this is often confusingly abbreviated to just "BTU". In the United Kingdom and other parts of the world it is written BTU.

The unit **MBTU** was defined as one thousand BTU presumably from the Roman numeral system where "M" stands for one thousand (1,000). This is easily confused with the SI mega (M) prefix, which adds a factor of one million (1,000,000). To avoid confusion many companies and engineers use **MMBTU** to represent one million BTU. Alternatively a *therm* is used representing 100,000 or  $10^5$  BTU, and a *quad* as  $10^{15}$  BTU.

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## Definitions

A BTU is defined as the amount of heat required to raise the temperature of one pound of liquid water by one degree Fahrenheit. Melting a pound of ice at 32 °F requires 143 BTU. As is the case with the calorie several different definitions of the BTU exist, which are based on different water temperatures and therefore vary by up to 0.5%:

Name or temperature	Value (J)	Notes
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39 °F	≈ 1059.67	Uses the calorie value of water at its maximum density (4 °C)
Mean	≈ 1055.87	Uses a calorie averaged over water temperatures 0 °C to 100 °C
IT	≡ 1055.05585262	The most widespread BTU, uses the International [Steam] Table (IT) calorie, which was defined by the <i>Fifth International Conference on the Properties of Steam</i> (London, July 1956) to be exactly 4.1868 J
ISO	≡ 1055.056	International standard ISO 31-4 on <i>Quantities and units—Part 4: Heat</i> , Appendix A. This value uses the IT calorie and is rounded to a realistic accuracy
59 °F	≡ 1054.804	Chiefly American. Uses the 15 °C calorie, itself defined as exactly 4.1855 J ( <i>Comité international</i> 1950; PV, 1950, 22, 79–80)
60 °F	≈ 1054.68	Chiefly Canadian
63 °F	≈ 1054.6	
Thermochemical	≡ 1054.35026444	Uses the "thermochemical calorie" of exactly 4.184 J

## Conversions

One BTU is approximately:

- 1,054–1,060 J (joules)
- 252–253 cal (calories)
- 25,031–25,160 ft·pdl (foot-poundal)
- 778–782 ft·lbf (foot-pounds-force)

Other conversions:

- In natural gas, by convention 1 MMBtu (1 million BTU, sometimes written "mmBTU") = 1.054615 GJ. Conversely, 1 gigajoule is equivalent to 26.8 m<sup>3</sup> of natural gas at defined temperature and pressure. So, 1 MMBtu = 28.263682 m<sup>3</sup> of natural gas at defined temperature and pressure.
- 1 standard cubic foot of natural gas ≈ 1030 BTU (between 1010 BTU and 1070 BTU, depending on quality)

## Associated units

The BTU per hour (BTU/h) is the unit of power most commonly associated with the BTU.

- 1 watt is approximately 3.41 BTU/h
- 1000 BTU/h is approximately 293 W
- 1 horsepower is approximately 2,544 BTU/h
- 1 "ton of cooling", a common unit in North American refrigeration and air conditioning applications, is 12,000 BTU/h. It is the amount of power needed to melt one short ton of ice in 24 hours, and is approximately 3.51 kW.
- 1 *therm* is defined in the United States and European Union as 100,000 BTU—but the U.S. uses the BTU<sub>59 °F</sub> whilst the EU uses the BTU<sub>IT</sub>.
- 1 *quad (energy)* (short for quadrillion BTU) is defined as 10<sup>15</sup> BTU, which is about one exajoule (1.055 × 10<sup>18</sup> J). Quads are used in the United States for representing the annual energy consumption of large economies: for example, the U.S. economy used 99.75 quads/year in 2005. [1] (<http://wilcoxon.cp.maxwell.syr.edu/pages/804.html>) . One quad/year is about 33.43 gigawatts.

The BTU should not be confused with the Board of Trade Unit (B.O.T.U.), which is a much larger quantity of energy (1 kW·h, or about 3412 BTU).

## See also

- Conversion of units
- Metrication

## External links

- The Units of Measurement Regulations 1995 ([http://www.opsi.gov.uk/si/si1995/Uksi\\_19951804\\_en\\_2.htm](http://www.opsi.gov.uk/si/si1995/Uksi_19951804_en_2.htm))
- Natural Gas: A Primer ([http://www2.nrcan.gc.ca/es/erb/CMFiles/Natural\\_Gas\\_Facts209JLL-06032006-3651.pdf](http://www2.nrcan.gc.ca/es/erb/CMFiles/Natural_Gas_Facts209JLL-06032006-3651.pdf))

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